Landscape and Remote Sensing Update
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I&M Activities

It's time to conduct another comprehensive survey of Networks about landscape/remote sensing projects and write up a more comprehensive, brief summary of these activities across the program. Our feeling is that the number and scope of projects has dramatically increased in the past year. I think we know of many (most?) 'official' projects supported by I&M funds, but there seem to be many other projects developing from the relationships that networks have established over the past years. Network and regional coordinators should expect to hear from us in the next month or two, and when you do, please help by providing brief description of projects (a descriptive project title and one or two sentences are adequate for most). We'll pick out a few projects that are farther along, and describe these in more detail, focusing on highlights and results that can be used by other networks.

Remote sensing subcommittee

A remote sensing subcommittee and here's the purpose statement from the draft charter:

> The purpose of the National Park Service Remote Sensing Subcommittee (RSS) is to improve planning, coordination, and technical support for park scientific research and management. The RSS will provide guidance to the GISC on the use of remote sensing for GIS and related technologies and communicate the current capabilities and status of sensors, software and applications. The RSS will also encourage best practices to managers and practitioners who make use of the technology and/or products.

We're both members of the subcommittee (which doesn't yet officially exist), and our hope is that this will help draw together resources and people across NPS. One early focus is on re-organizing and updating the various web sites that relate to RS issues. An idea with some support is to consolidate information at a single location, and an immediate impact of this decision would be to move RS-specific info from the I&M Landscapes page to this new site. We also felt we need to do a better job of summarizing information, rather than just providing links. If you have suggestions on how this site could better serve your needs, please let us know.

A Selection of Activities with NASA

A major thrust in the last year has been to establish broader and more robust relationships between NASA and NPS in general, and I&M in particular.

- In January 2005, NPS and NASA signed a MOU supporting partnership activities between the agencies. Woody Tuner and John Gross are agency contacts (i.e., emphasis on NR applications)
- I&M co-sponsored a workshop with NASA, Parks Canada Agency, Canadian Center for Remote Sensing, and Canadian Space Agency. The workshop presentations and associated materials are posted on the I&M web site. See http://science.nature.nps.gov/im/monitor/rs_pa_workshop.htm for the pre-workshop materials and http://science.nature.nps.gov/im/monitor/narsec_meetings.htm for the workshop presentations and other workshop products.
- Participation in NASA Ecological Modeling Workshop (NASA sponsored participation)
- NASA DEVELOP intern project in Yosemite NP. This project examined LandSat images from 1973-2004 to evaluate their use for describing post-fire succession. See

http://develop.larc.nasa.gov/ for information. We worked with the western division of the program, and it appears the 2006 interns will be based in Alaska.
- Implementation of an ecosystem model for YOSE by NASA Ames scientist Rama Nemani's group. This is an on-going activity.
- NASA scientists Rama Nema and Woody Turner co-authored a paper with John Gross on the use of remotely-sensed data to monitor park resources. To be published in Park Science in early 2006.
- Submission of monitoring proposal to NASA (first attempt denied; we just resubmitted)
- John Gross is a collaborator on a new NASA-funded project with Andy Hansen and Steve Running that is to examine past and forecast effects of climate and land use changes on 70 large parks from 1900-2030.
- NASA funded proposal to enhance use of remotely sensed data for managing weeds related to fire (NASA lead is Jeff Morisette; Brad Welch, Kara Paintner, and Nate Benson are co-PIs).

Acronyms and jargon:

LULC	Land use land cover (change)
Landsat	NASA satellite with 30 m pixel; long-term workhorse for land cover studies, but current satellite is malfunctioning and future is uncertain.
IKONOS	High-resolution satellite imagery (1 m B&W; 4 m color)
MRLC	Multi-Resolution Land Characteristics Consortium. Purchased nationwide Landsat imagery and producing National Land Cover Data (NLCD) maps about every 10 years.
NLCD	Nation Land Cover Data – see above
RS	Remote sensing

Update of Key Network Activities

Draft Protocols: GRYN, NCRN and NCCN have draft protocols for landscape-level monitoring, and the protocols are very different in terms of the focus and types of analyses. There is a large variation in the scale and focus on the analysis and questions. All three have a land cover component (e.g., vegetation community change), and this is the primary focus of the NCCN protocol. GRYN and NCRN have major emphases on anthropogenic changes, but the scales and approaches differ. Here are brief summaries of the 3 draft protocols, and one other:

NCCN – Draft protocol focuses on changes in natural habitats, inside or immediately adjacent to park boundaries. Clear cuts would be detected, but there is no emphasis on land use intensification (cropping, exurban development, etc.) nor is there consideration in the protocol on fragmentation, connectance, or other landscape patterns. Analyses are based on using Landsat (30m) data. The general focus is to evaluate changes in spectral attributes, rather than a cover class (e.g., forest, grass) because no good base map of cover classes exists. The overall approach is innovative and widely transferable to other networks, and the PIs (Warren Cohen and Robert Kennedy) are now working with SWAN and NCPN.

GRYN – The protocol addresses land cover and certain land use changes inside and outside GRYN parks. Unlike other protocols, it integrates image analysis with ancillary data (census data, land ownership, etc.) to develop a richer picture of land use changes. In addition, there's an explicit objective to link LULC changes to habitat qualities indicative of 'biodiversity value'. Much of the approach follows the HTLN report, which was conducted by the same PI (Andy Hansen).

Extensive use and leveraging of existing data (i.e., produced by other agencies) is a real and unique strength of this protocol.

NCRN – Protocol examines vegetation change, land use/cover change, and explores use of graph theory to evaluate connectance and the importance of specific habitat patches to ecological integrity. The project examined the effect of image resolution (1 m, 4 m, 10 m, 15 m 30 m) and on the scale of the area of interest on results. Section on field data collection for validation using fuzzy logic is unique to this protocol and has some real advantages over more traditional alternatives. This project uses a much more theoretical approach than others, and includes an SOP for exploring FragStat outputs and using random maps for comparison.

	APHN	CAKN	CUPN	ERMN	GLKN	GRYN	GULN	HTLN	KLMN	MEDN	NCBN	NCCN	NCPN	NCRN	NETN	PACN	ROMN	SCPN	SECN	SFAN	SIEN	SODN	SWAN	UCBN	Grand Total
Extreme disturbance events												1								1					2
Fire and fuel dynamics	1	1	1		1	1	1			1		1	1					1	1	1	1	1		1	15
Landscape dynamics	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	24
Nutrient dynamics			1	1	1						1		1								1				6
Productivity		1		1	1						1		1	1				1			1	1			9
Soundscape		1			1	1	1						1					1		1	1				8
Viewscape/ Dark Night Sky													1	1		1		1		1	1				6

GLKN – Does not have a draft protocol, but learned a few lessons from their contract with Paul Bolstad. The approach suggested during meetings for broad-scale LULC required a ground truthing program that was far too expensive.

HTLN – 2003 report (Hansen and Gryskiewicz 2003) is still a benchmark for using a broad range of existing datasets to evaluate broad-scale land use changes and their potential impacts on parks. Current project with is examining use of high-resolution imagery (aerial and IKONOS) for quantifying land use adjacent to parks. Work for GRYN built on approach developed for HTLN.

GLKN – have just commissioned a study on monitoring river-based (long, linear) parks with Volker Radeloff (U. Wisc).

NETN – Y.Q. Wang is examining land use changes along the Appalachian trail using ground photographs, Landsat, and some high-resolution imagery. Classifying land use changes at a small number of selected sites along the trail. Y.Q. has also been examining use of RS data for vegetation change for the past couple years.

Table 1 - Summary of landscape dynamics Level 3 vital signs, by network. This chart represents the smallest number of network because of ambiguities on how network vital signs are assigned to national categories. Severe defoliation from insects might be classified as “extreme disturbance”, or it might be classified as “insect pests”. Thus landscape-scale monitoring may directly contribute to a broad range of vital signs. (Data from 10/7/2005 version of vs_summary.mdb)

Trends and lessons in vital sign monitoring and what we can do at the national level.

All networks have a desire to conduct 'landscape dynamics' monitoring, but the attributes of interest, spatial scale, and desired approaches are very different. Here's a *very* short summary of suggestions and lessons learned for some general questions and approaches

Broad-scale change monitoring (e.g. around parks)

1. An integrated approach that leverages non-RS data sources (e.g., census, agriculture, roads, etc.) provides a more economical and integrative result than relying on image classification
2. Approaches that do not rely on highly accurate classified maps, but instead evaluate image-to-image change, are much more economical.
3. The use of coarse-resolution data at frequent intervals to identify areas of change, supplemented by less frequent fine-resolution data to identify what or how it's changed, seems like the most promising approach for large areas. NCCN and Parks Canada researchers (Robert Fraser) are leading the charge.

Within-park monitoring, mostly vegetation change

The use of RS data to monitor vegetation community changes seems to have a large number of important site-specific traits, and no universal approach seems likely. Big questions relate to the resolution and cost of data that are necessary to detect key changes (and these changes vary with region), and on approach. SODN, KLMN, NCBN, and SFAN have parks that are or have examined the efficacy of RS imagery that varies in resolution or is an alternative to aerial.

With the addition of an I&M Remote Sensing Coordinator position, there will be more support for the Regions and Networks in the future. How can this position be structured in order to provide maximum support? Some of the potential activities were presented at the IMAC meeting – these include education/training, data acquisition, and data analysis (Handout can be provided). How should these activities be prioritized? Are there activities that were missed and should be considered? Your input would be appreciated.